EFFICIENT PLASMA PRODUCTION IN LOW BACKGROUND NEUTRAL PRESSURES WITH THE M2P2 PROTOTYPE

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ABSTRACT

Mini-Magnetospheric Plasma Propulsion (M2P2) seeks the creation of a large-scale (10 km radius) magnetic wall or bubble (i.e. a magnetosphere) by the electromagnetic inflation of a small-scale (20 cm radius) dipole magnet. The inflated magnetosphere will intercept the solar wind and thereby provide high-speed propulsion with modest power and fuel requirements due to the gain provided by the ambient medium. Magnetic field inflation is produced by the injection of plasma onto the dipole magnetic field eliminating the need for large mechanical structures and added material weight at launch. For successful inflation of the magnetic bubble a beta near unity must be achieved along the imposed dipole field. This is dependent on the plasma parameters that can be achieved with a plasma source that provide continuous operation at the desired power levels of 1 to 2 kilowatts. Over the last two years we have been developing a laboratory prototype to demonstrate the inflation of the magnetic field under space-like conditions. In this paper we will present some of the latest results from the prototype development at the University of Washington and show that the prototype can produce high ionization efficiencies while operating in near space like neutral background pressures producing electron temperatures of a few tens of electron volts. This allows for operation with propellant expenditures lower then originally estimated.

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